



Armed Forces College of Medicine AFCM





Dementia & Tumors of The Nervous System 1

By
Dr Noha El Anwar





Good
Morning

Have a beautiful day



INTENDED LEARNING OBJECTIVES (ILO)



By the end of this lesson the student will be able to:

- 1-Identify pathological changes of Alzheimer disease and Lewy body dementia
- 2- Classify Tumours of The Nervous System according to site and cell of origin.
- 3 - Describe The Pathological Features Of Gliomas.
- 4- Analyse given data to diagnose pathological conditions of Gliomas based on given clinical, radiologic data and/or laboratory findings



Alzheimer Disease



- **Alzheimer disease (AD)** is the most common cause of **dementia** in the elderly.
- **Risk factors** include **aging** and significant **head trauma**
- **Protective factors** include **high level of education**
- **There are 3 genes that cause autosomal dominant AD:**
 - ❖ **APP** (amyloid precursor protein)
 - ❖ **Presenilin 1 and 2 (PSEN1 and 2)**
- **Carriers** of *APP* and *PSEN1* mutations **develop early-onset AD**

Alzheimer's Disease Risk Factors:



Age



Family history



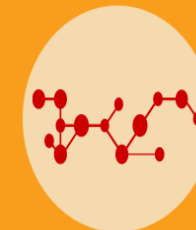
Coexisting genetic diseases



Lack of education



Female gender



Diabetes



Environmental hazards



Head injury

Source: healthdiseaseblog.com/2016/11/treatment-options-Alzheimers-disease.html
© The Health and Disease Blog



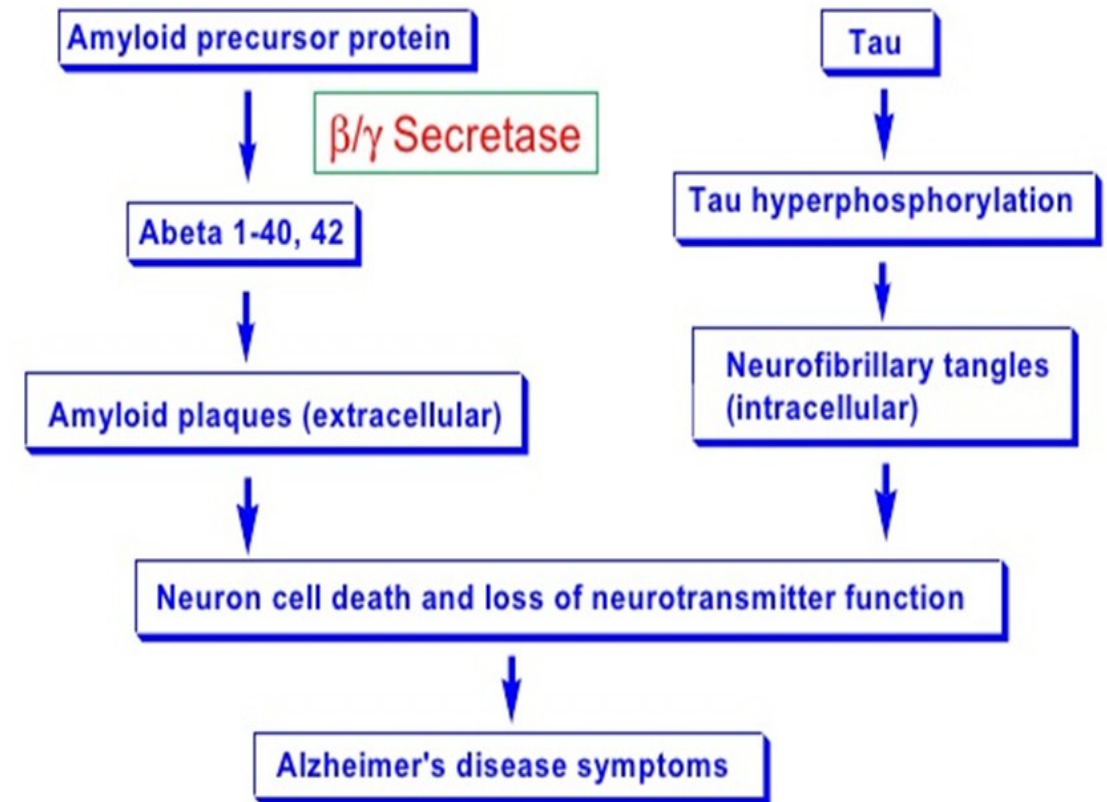
Alzheimer Disease



Pathogenesis:

- The fundamental abnormality in AD is the **accumulation of two proteins (amyloid A β and tau)** in specific brain regions (**temporo-parietal**) in the forms of **plaques and tangles**
- Changes result in secondary effects including **neuronal dysfunction, neuronal death, and inflammatory reactions.**

Alzheimer's Disease Pathophysiology



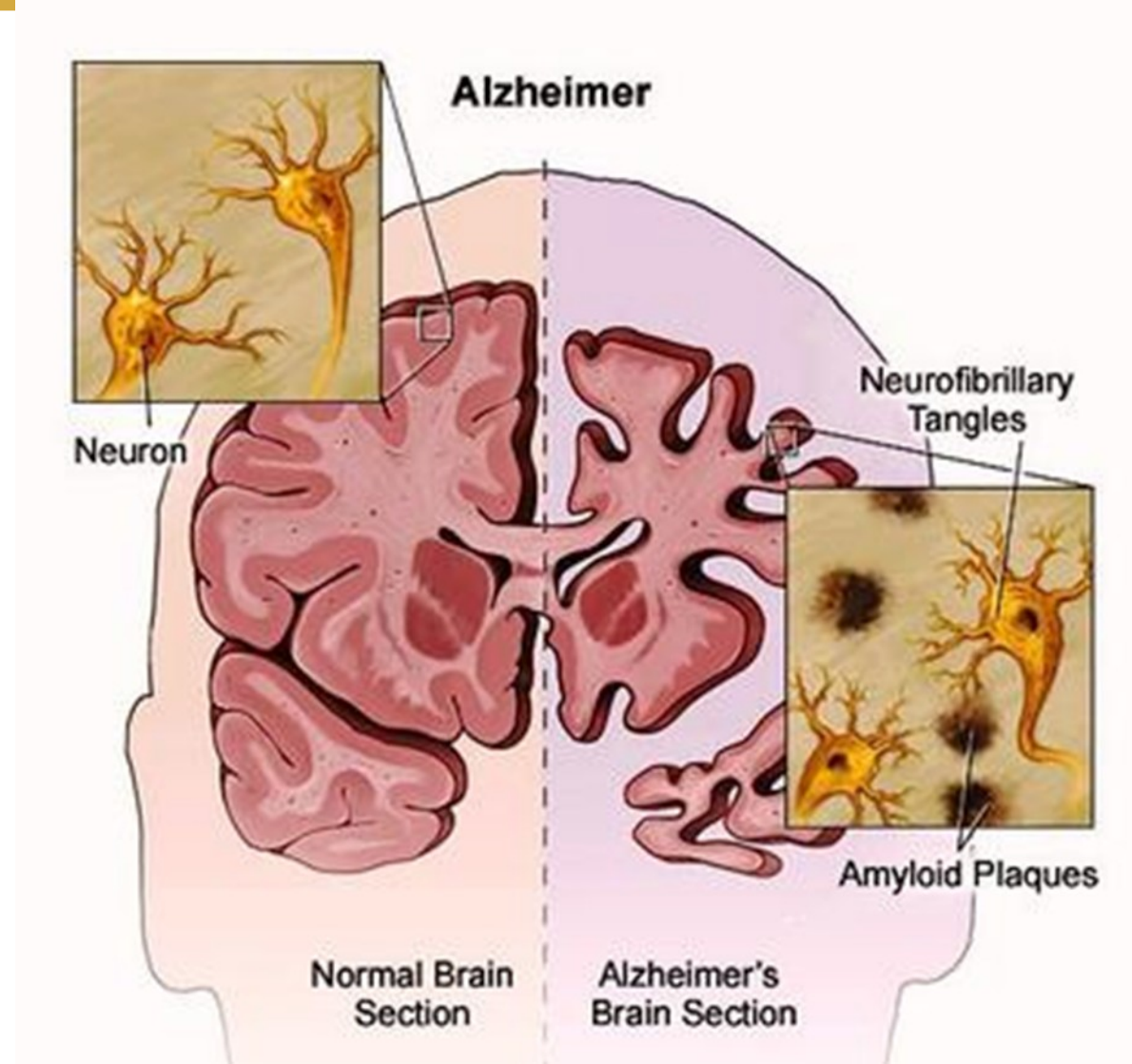
<https://image.slidesharecdn.com/macrocyclesasbace1inhibitors-12778490705528-phpapp02/95/macrocycles-as-bace-1-inhibitors-2-728.jpg?cb=1277831119>



Alzheimer Disease



- **Plaques** are deposits of **aggregated $A\beta$ peptides** in the **neuropil (Extracellular)**
- **Tangles** are aggregates of the **microtubule binding protein tau**, which develop **(intracellular)** **Gross picture:**
- **Cortical atrophy** with widening of the cortical sulci and dilatation of the ventricles.



https://pharmacistformulas.files.wordpress.com/2015/03/alzheimers_disease_pathology.jpg



Alzheimer Disease

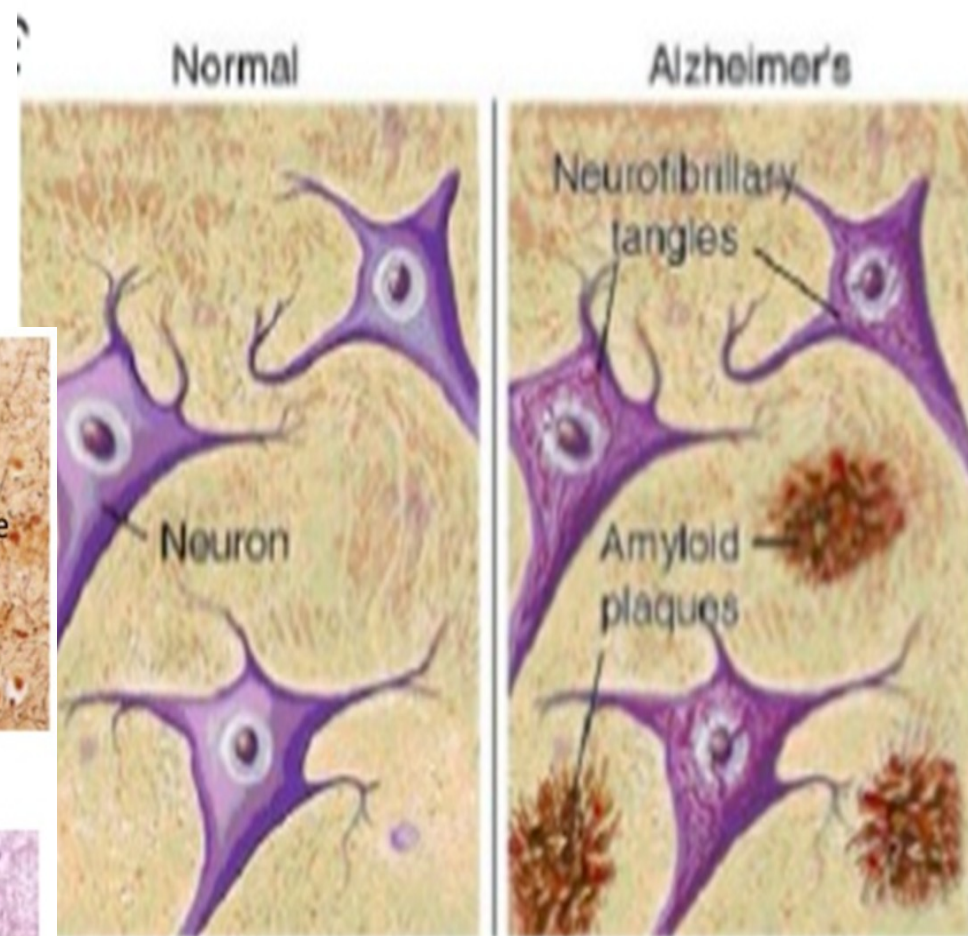
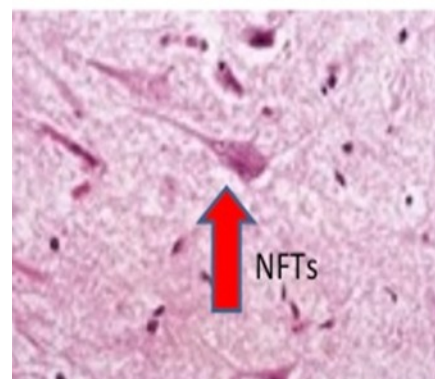
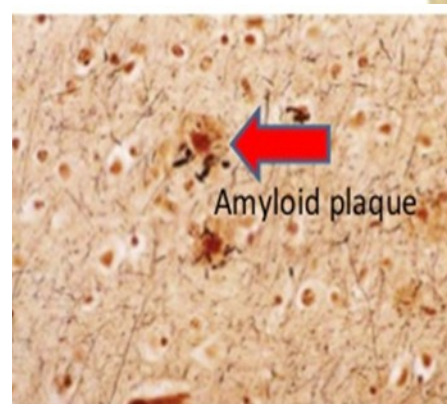


• Microscopic :

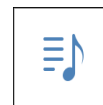
i) **Senile neuritic plaque** is the most characteristic lesion and consists of focal area which has a central core containing **Ab amyloid**.

ii) **Neurofibrillary tangle** is a filamentous collection of **neurofilaments** and **neurotubules** within the **cytoplasm** of neurons.

iii) **Amyloid angiopathy** is deposition of the same amyloid in **the vessel wall** which is deposited in the amyloid core of the plaque.



<https://image.slidesharecdn.com/alzheimersdisease-141109072026-conversion-gate01/95/alzheimers-disease-7-638.jpg?cb=1415517668>



Alzheimer Disease



- Affected brain areas are involved in **learning and memory**.

Clinical Picture:

- **Clinical manifestations** have insidious onset.
- They include **progressive memory impairment**, especially related to **recent events**; alterations in **mood and behaviour**; and progressive **disorientation**.



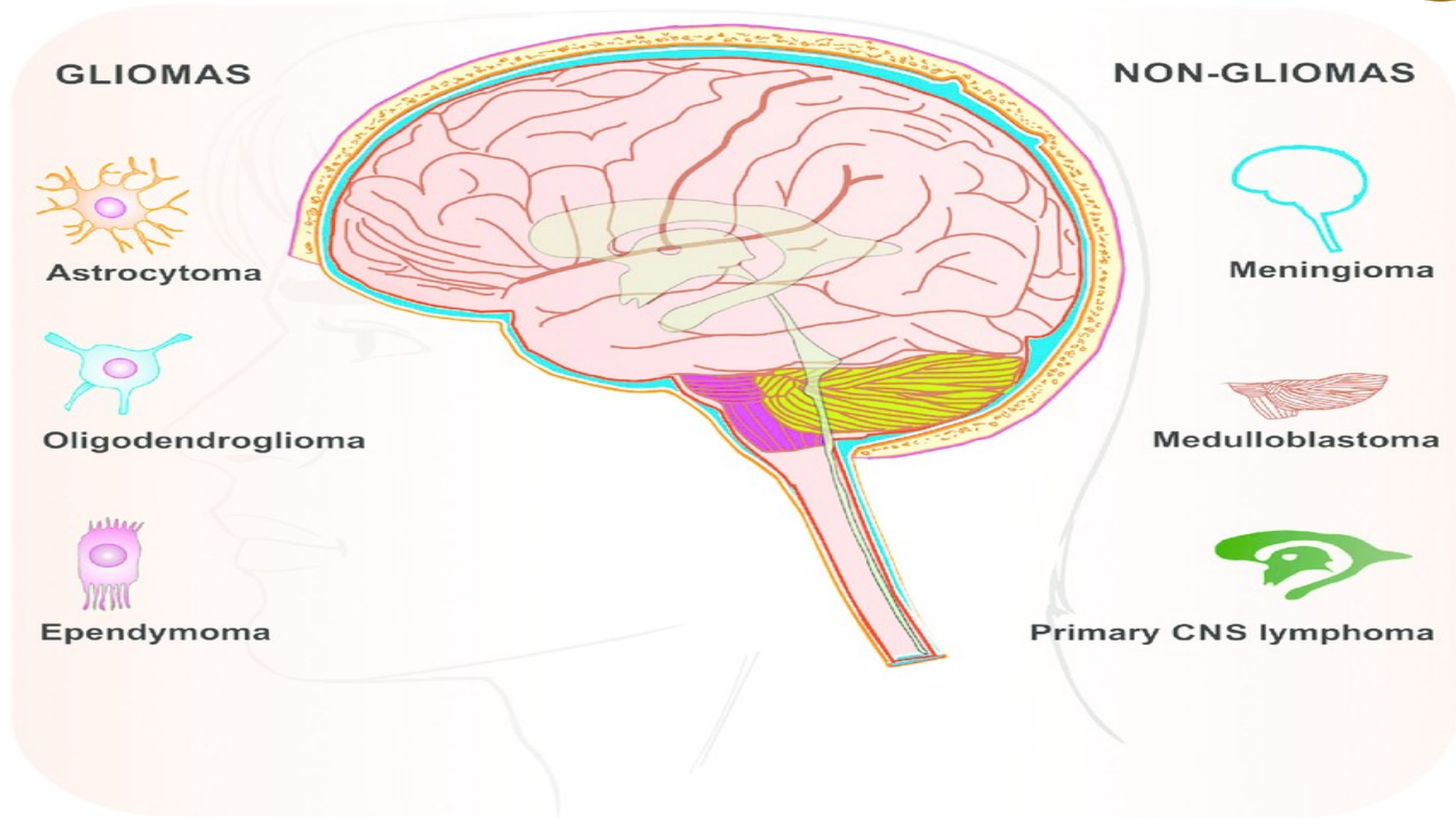
Lewy Body Dementia



- **Lewy body dementia** is a progressive brain disease associated with the formation of Lewy bodies in neurons involving **neocortex and subcortical nuclei**.
- The pathogenesis is obscure, with no known risk factors.
- it is the **second leading cause** of degenerative **dementia** in the elderly.
- **The histopathological hallmark** is the **Lewy body**. **Neuron loss** accompanies **Lewy body formation**.
- **Clinical manifestations** include memory loss and visual hallucinations.



Primary CNS Tumors



https://www.researchgate.net/profile/Meenakshi_Malhotra/publication/279213555/figure/fig1/

AS:391931101237254@1470455064485/Schematic-diagram-showing-the-specific-types-of-cells-involved-in-brain-cancer.png



Effect of CNS Tumors



• **Complications of brain tumors:**

1- Increased intracranial pressure leading to:

headache, vomiting, blurred vision due to papilledema, tremors.

2- Pressure on vital centers.

3- Brain atrophy which is responsible for paralysis or dementia.

4- Invasion and brain tissue destruction.

5- Cerebral edema.

6- Irritation effects in the form of seizures or epileptic fits.

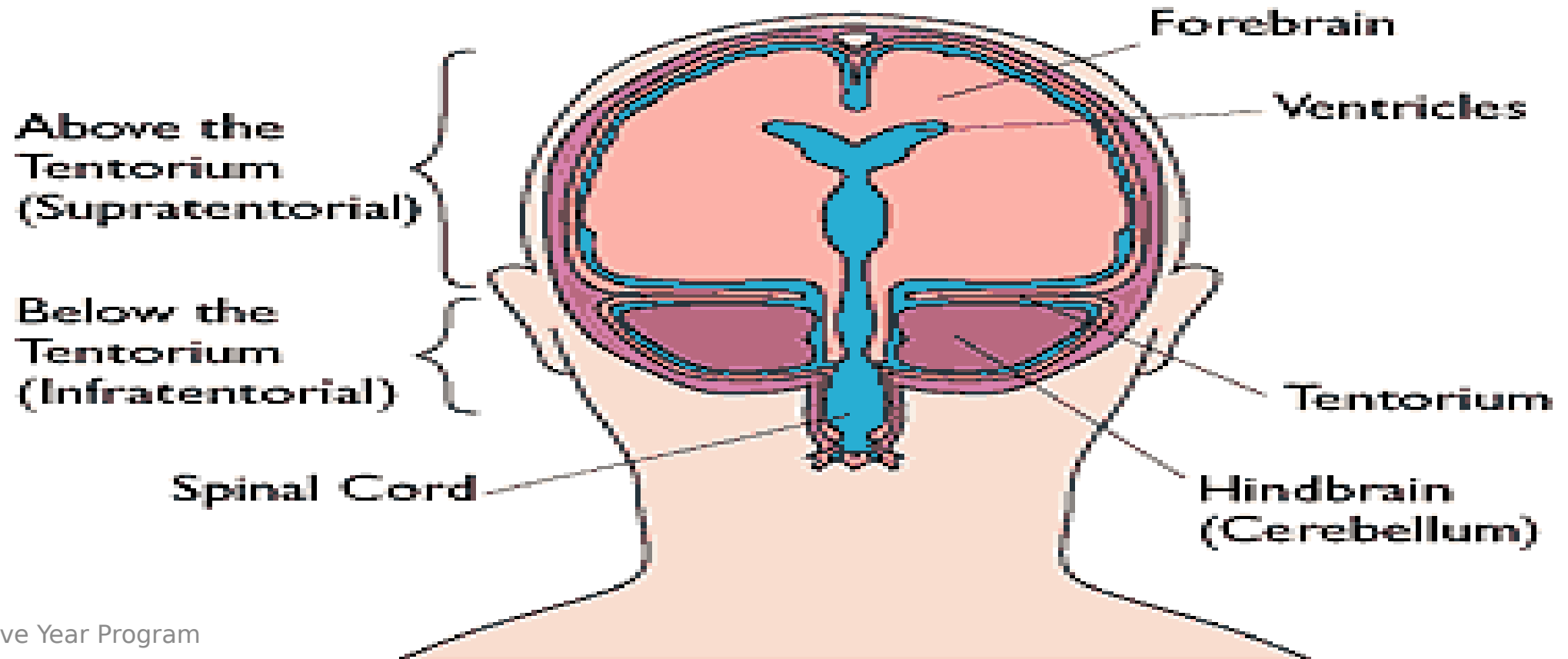


Primary CNS Tumors



Classification

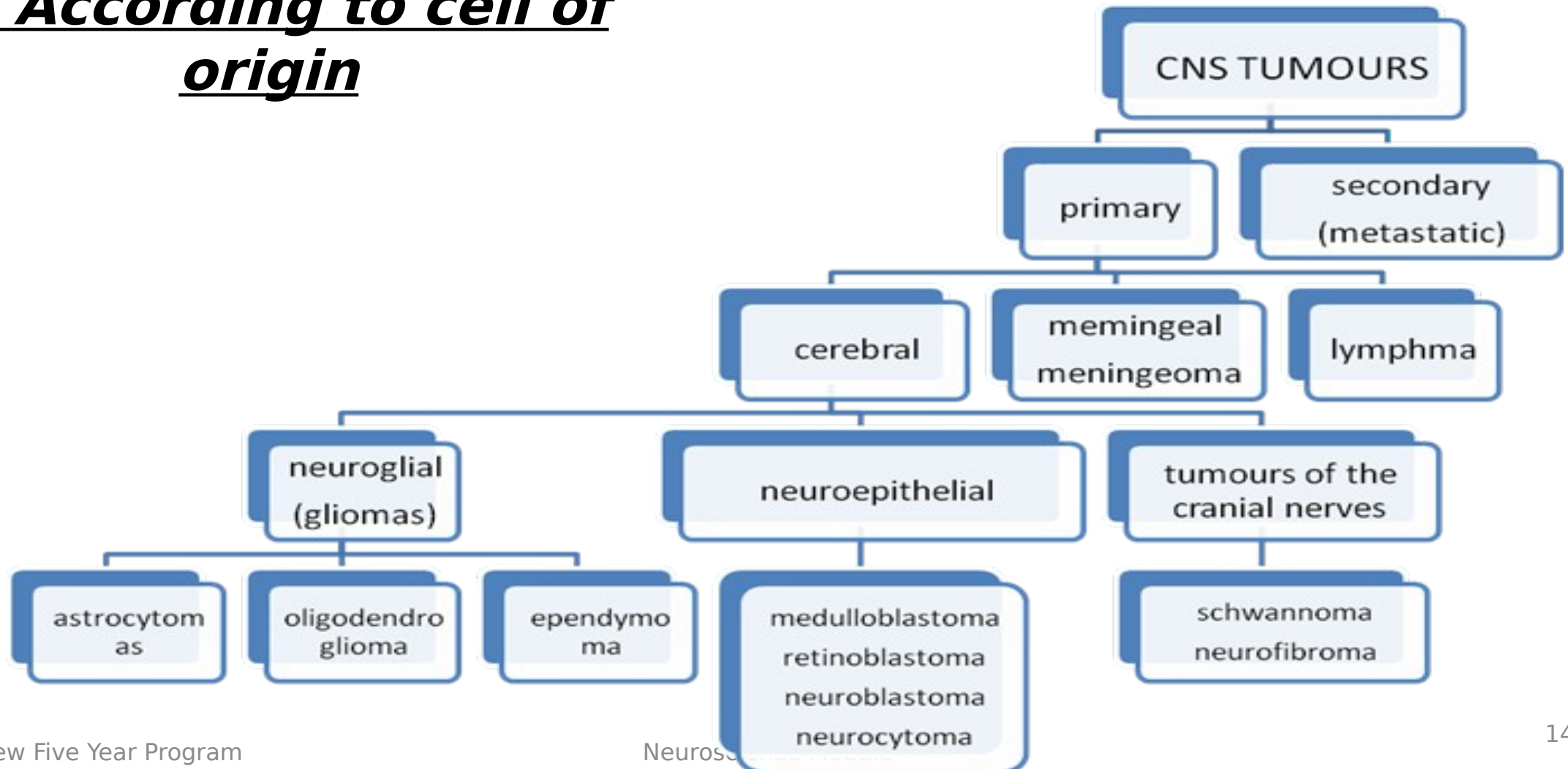
A) According to site



Tumors of The Nervous System



B) According to cell of origin



Tumors of The Nervous System



C) According to WHO

(World Health Organization) Grading System

This depends on many factors including:

- rate of growth, clinical behavior, tumor cellularity , tumor vascular pattern & tumor necrosis.
- All primary tumors of CNS can be graded as
- WHO grade: I,II, III or IV with grade IV tumors the most aggressive one.



A) ASTROCYTOMA: Most common primary tumor of CNS.

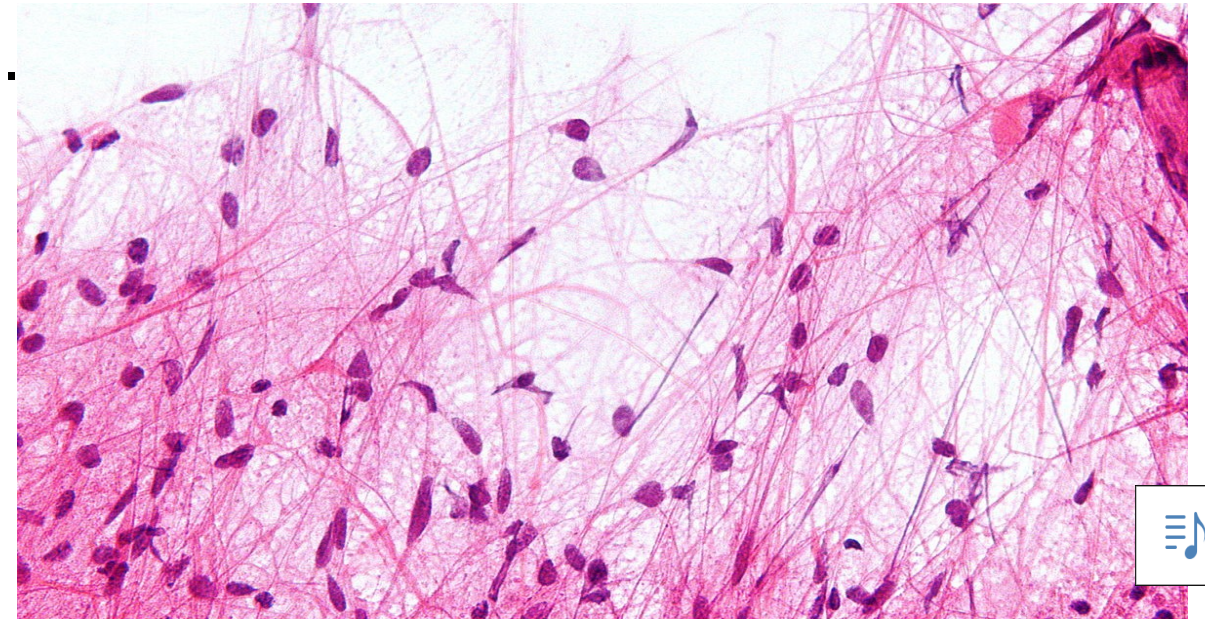
1- Pilocytic Astrocytoma (WHO Grade I): This is the only astrocytic tumor with good news ☐ (considered benign). It usually affects children. It mainly occurs in the cerebellum.

Gross

It appears as circumscribed
thin hair like processes
Cystic mass with a solid mural nodule.

Microscopically

It consists of bipolar astrocytes with long,



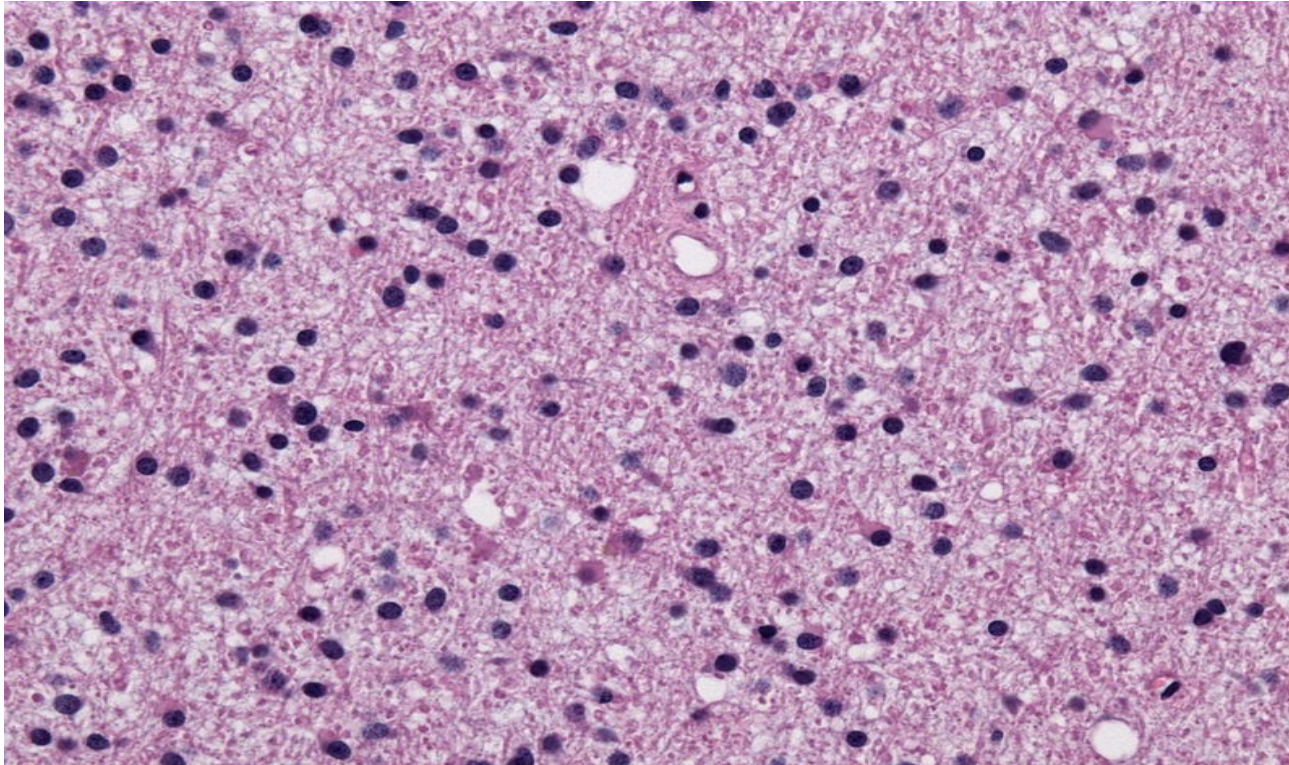
Astrocytoma



2- Low Grade Astrocytoma (WHO Grade II) (Diffuse astrocytoma):

The tumor is more common in adults and usually affects the cerebral hemispheres .

Gross



Moderate cellularity
Moderate cellular atypia.
No mitosis



Astrocytoma

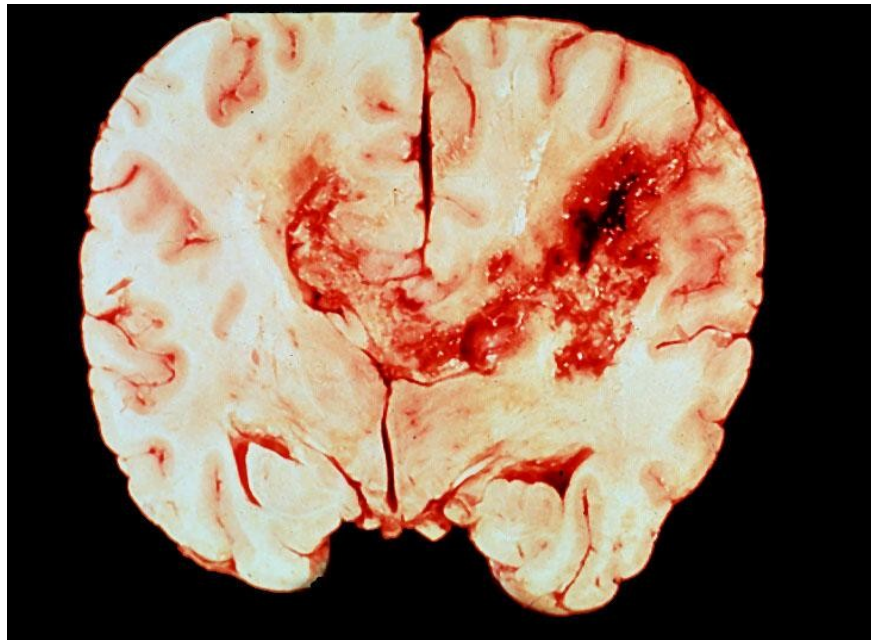


3- Anaplastic Astrocytoma (WHO Grade III):

It usually affects the cerebral hemispheres of adults.

Grossly

Infiltrative growth.



New Five <https://tse3.mm.bing.net/th?id=OIP.aweZVobV5FgjxNNrj7O7QwHaFb&pid=Api&P=0&w=220&h=162> Year Program

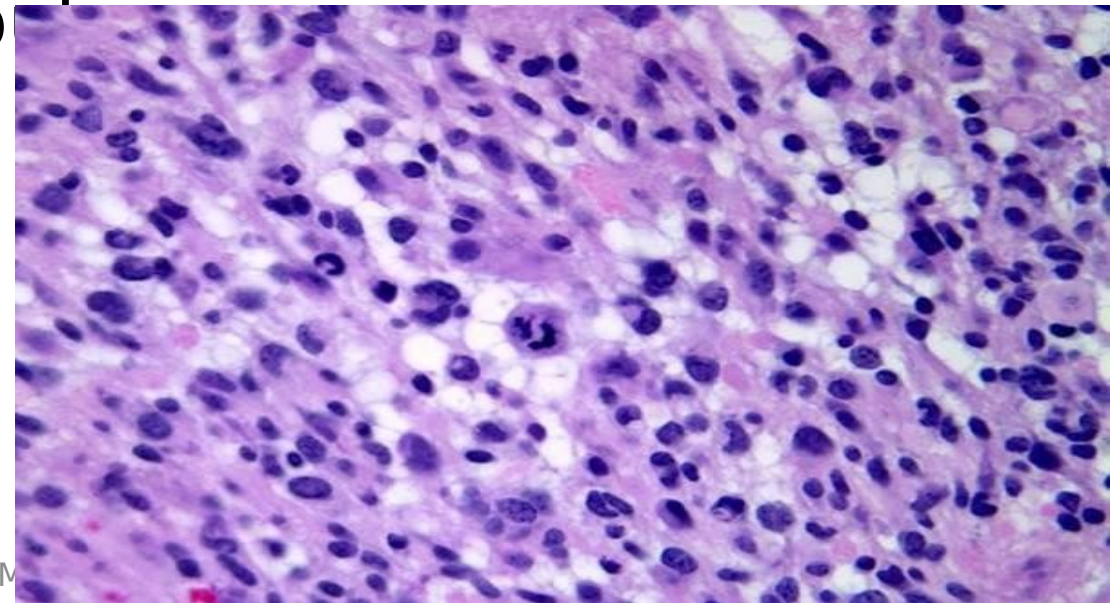
Microscopically

Highly cellular

composed of pleomorphic

astrocytes with mitotic activity,

b



Neuroscience M

18

<https://classconnection.s3.amazonaws.com/695/flashcards/739695/jpg/271227121102211>

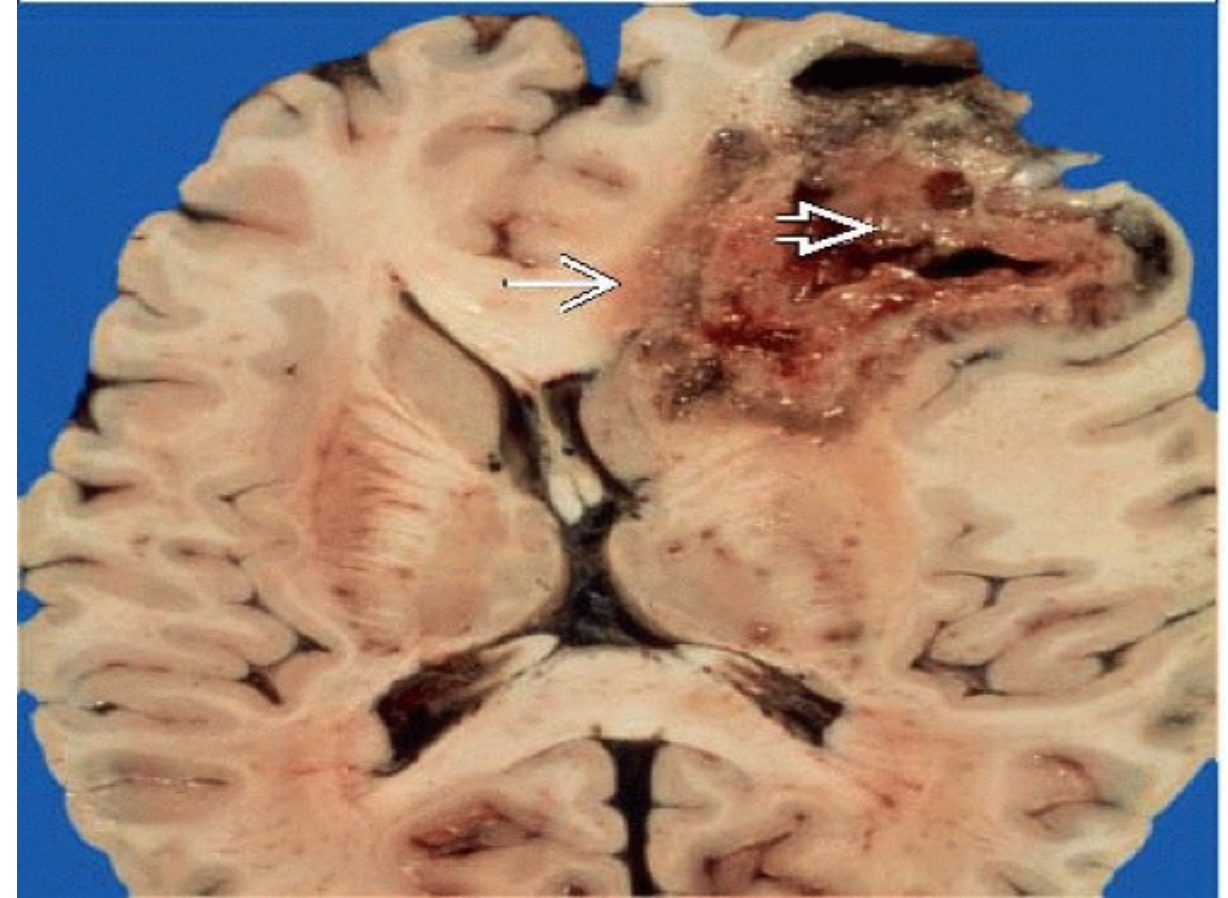


Glioblastoma multiforme (WHO Grade IV):

- A highly malignant tumor ☐☐
- More common in adults
- in the Cerebral hemispheres

Grossly

- Infiltrative growth
- Usually large-sized
- Showing hemorrhage, necrosis & cysts.



https://tse4.mm.bing.net/th?id=OIP.UxGtfUN15zGQEb1_coDTHAHaE8&pid=Api&P=0&w=230&h=154



Astrocytoma



Microscopically

- High cellularity
- Marked cell anaplasia

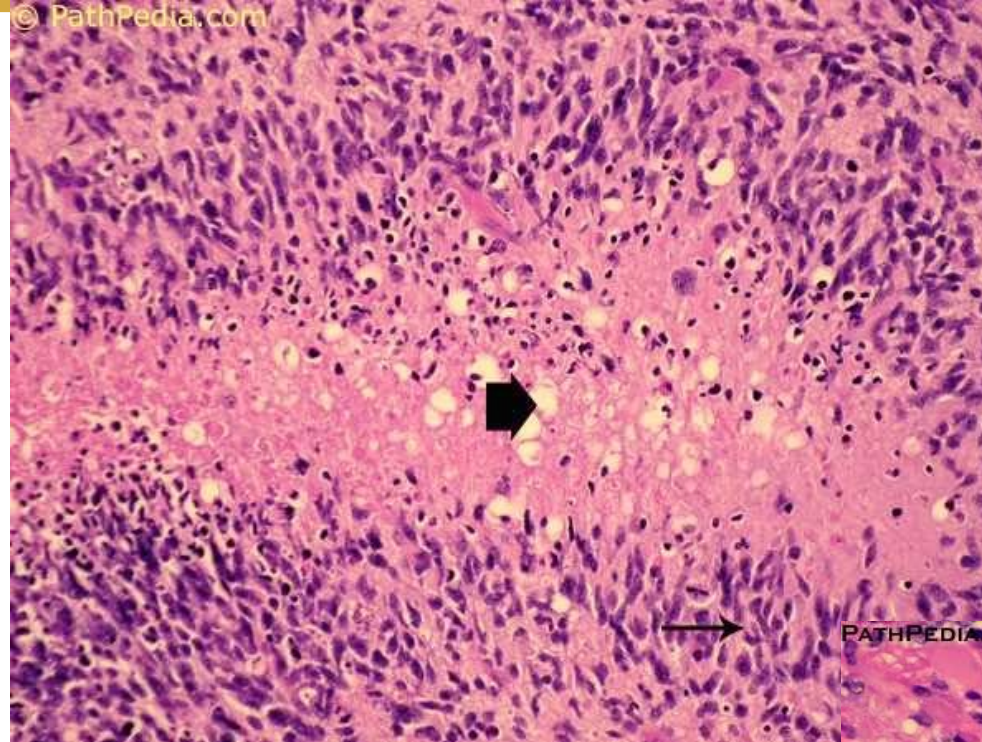


- **Necrosis (palisading)**
- **Vascular endothelial proliferation.**

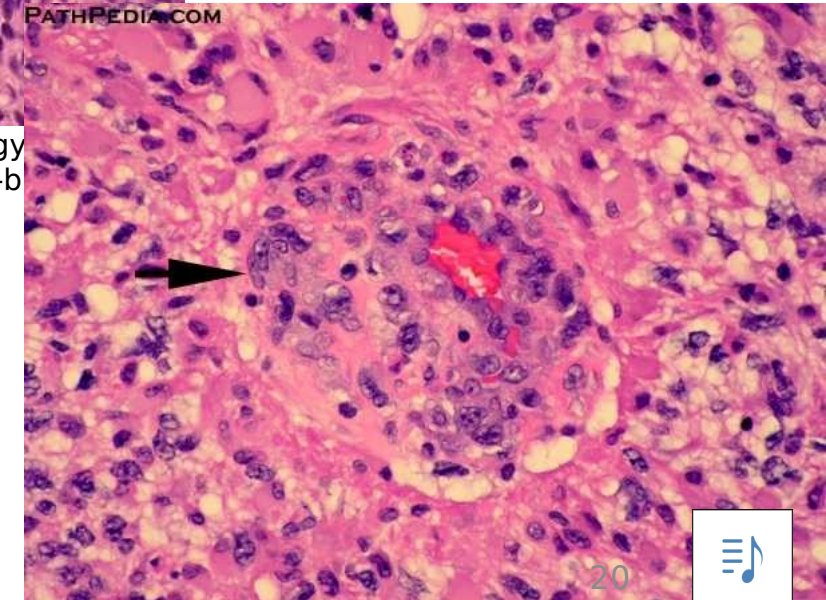
It is the most malignant primary brain tumor.

New Five Year Program

Neuroscience Module



[https://www.pathpedia.com/education/eatlas/histopathology/brain_and_cord/glioblastoma_gbm/glioblastoma-brain-\[2-b-Width=600&Height=450&Format=4](https://www.pathpedia.com/education/eatlas/histopathology/brain_and_cord/glioblastoma_gbm/glioblastoma-brain-[2-b-Width=600&Height=450&Format=4)



B) oligodendroglioma



A **rare** tumor occurring in **cerebral** hemisphere in **adults**.

usually a **WHO grade II** slowly growing neoplasm.

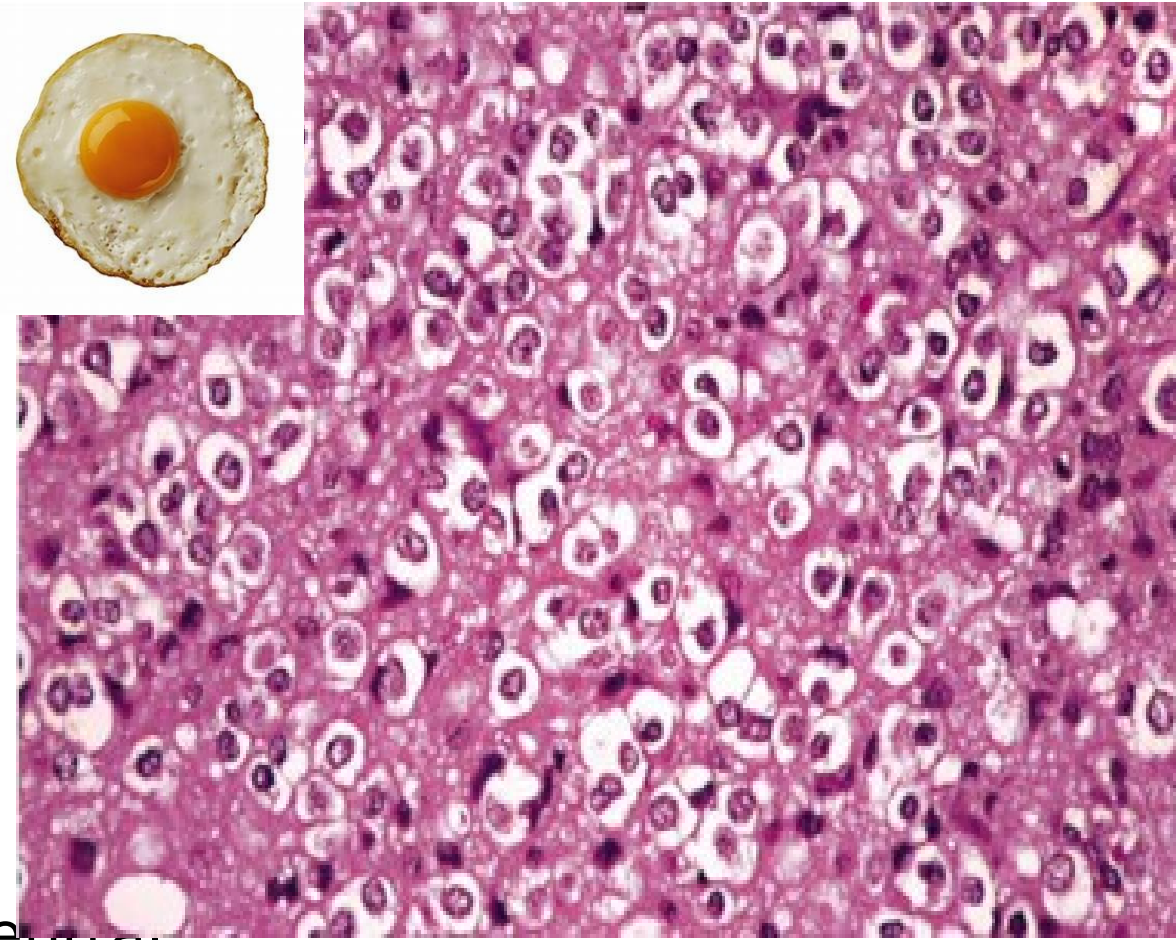
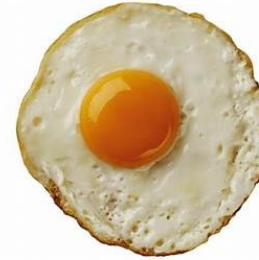
It is rarely grade III.

Gross: A circumscribed solid or gelatinous tumor, commonly showing calcifications visible on X-ray.

Microscopy:

There are sheets of uniform cells with:

- Uniform central nuclei.
- Clear halo of cytoplasm (surrounding the central nucleus) **fried egg appearance**.



https://classconnection.s3.amazonaws.com/252/flashcards/753252/png/perinuclear_halo_-_oligodendroglioma-141B474CFDB6ED568DA.png



C)Ependymoma



Tissue of origin: ependymal cells lining the ventricles or spinal canal.

It is typically located in:

- Children in the fourth ventricle, where it presents with obstructive hydrocephalus.
- Adults in the spinal cord as it is the most common site.

It includes: (WHO grade I, II and III)

Gross: brown fleshy mass arising in relation to the ventricular system.

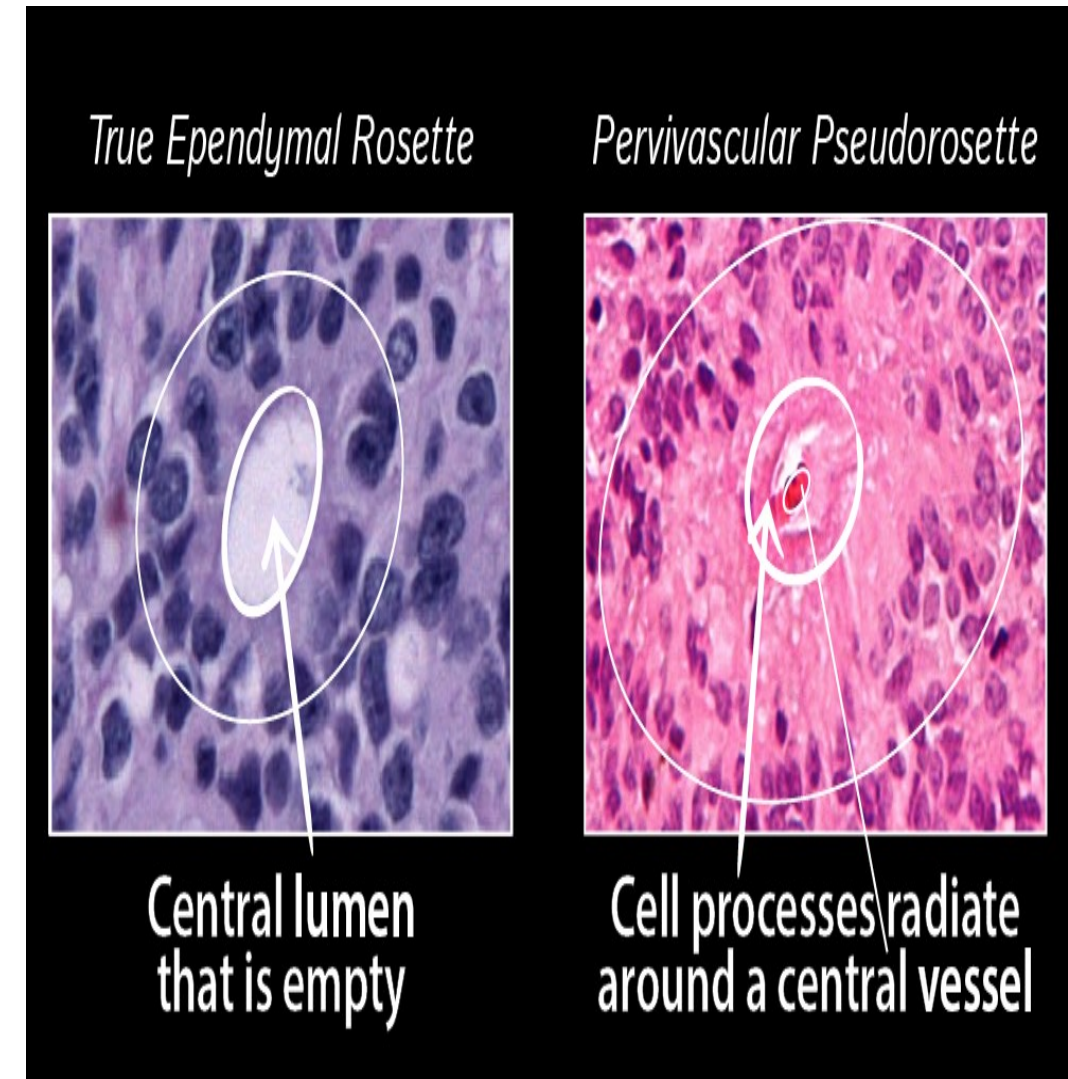


C)Ependymoma



Microscopy:

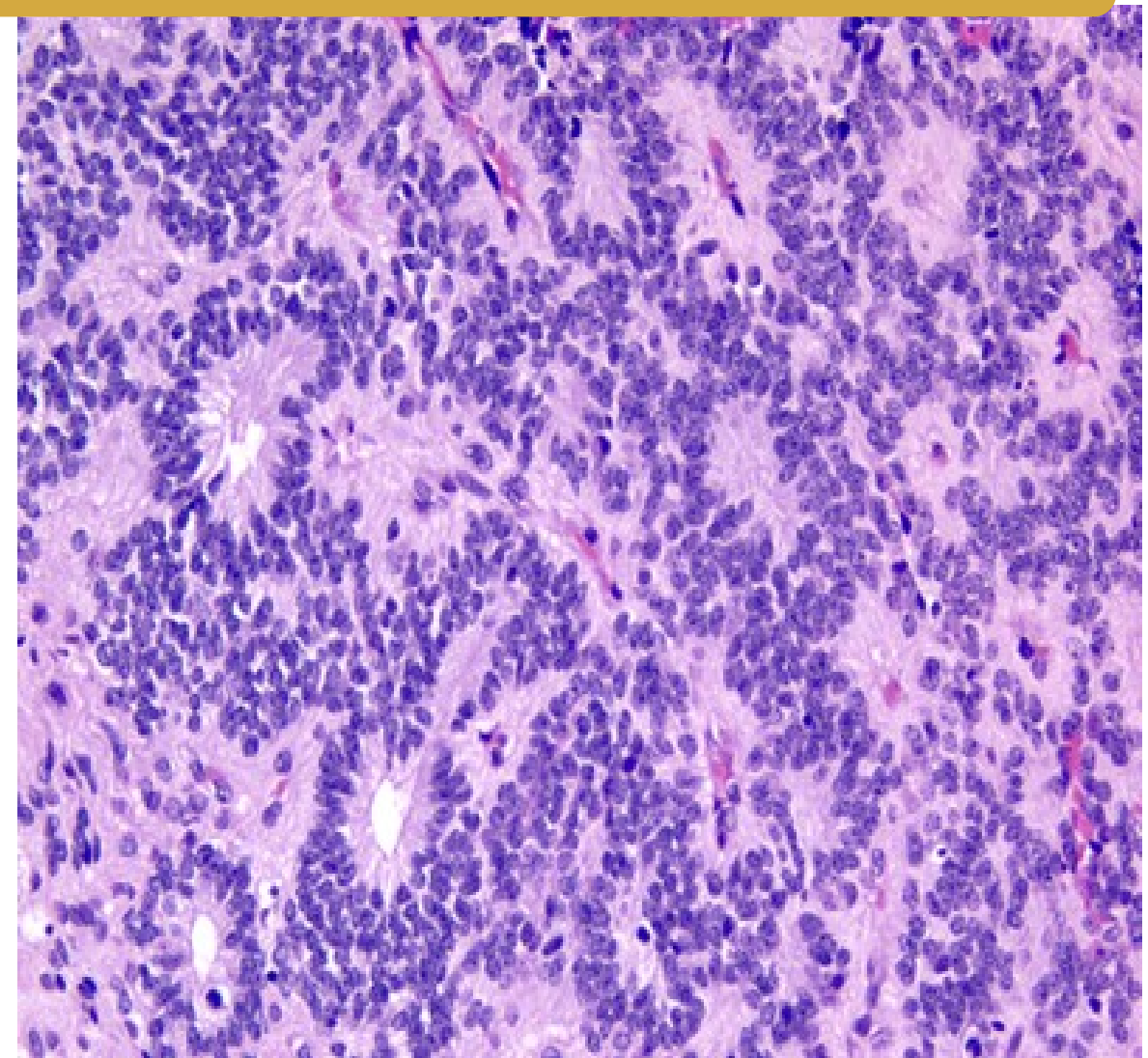
- **Classical ependymoma** is a cellular growth composed of small polygonal cells arranged around **empty spaces** forming **true rosettes** or arranged around vessels (**perivascular**) forming **pseudorosettes**



<https://d1j63owfs0b5j3.cloudfront.net/term/images/1751530608572870.png>



C)Ependymoma



This horizontal (axial) section of the brain reveals a large ependymoma filling the fourth ventricle

<http://neuropathology-web.org/chapter7/images7/7-16b.jpg>



D) Choroid plexus papilloma



Choroid plexus papilloma is a **rare** grade I tumor in the **ventricles** of **young children**.

It may lead to excess CSF secretion□ hydrocephalus.





the following sentences as T or F:

Disabling necrosis is an important feature of Grade I gliomas.
Pineal gland papilloma is a rare tumor of young children.
Oligodendrocytic astrocytoma is supratentorial tumor in children





1. Kumar, Vinay, and Abbas, Abul K, and Aster: Robbins Basic Pathology, 10th ed. (2018) Pages 880-887.
2. Mohan H., Mohan P., Mohan T & mohan S. (Eds.). (2015)
Text book of pathology 7 th edition



